Supplemental Material

Prenatal Polybrominated Diphenyl Ether Exposure and Body Mass Index in Children Up To 8 Years of Age

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Table of Contents

Table S7. Estimated differences and 95% confidence intervals in child anthropometric measures with 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid) by child sex, HOME Study

Table S8. Estimated differences and 95% confidence intervals in child anthropometric measures by 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid) with additional adjustment for environmental contaminants, HOME Study

Figure S1. Estimated differences and 95% CIs from multiple linear mixed models for associations between polybrominated diphenyl ether (ng/g lipid) tertiles and weight or height z-scores in children. All models adjusted for maternal age, race, education, income, maternal smoking status, maternal depression, and maternal fruit and vegetable intake during pregnancy. Weight z-score models were additionally adjusted for pre-pregnancy weight. Height z-score models were additionally adjusted for maternal height.

Table S1. Maternal concentrations of polybrominated diphenyl ether congeners[a] (ng/g lipid), HOME Study

PBDEs	n	Percent detection	Min	25th	50th	75th	95th	Max	GM (GSD)	NHANES[d] GM (GSD)
∑PBDEs[b,c]	287	100.0	4.5	20.7	35.8	72.5	213.7	2046.9	39.1 (2.6)	-[e]
BDE-17	287	3.1	0.1	0.3	0.3	0.4	1.0	4.0	0.4 (1.6)	-
BDE-28[c]	287	80.1	0.2	0.6	1.0	1.8	4.6	31.4	1.1 (2.3)	-
BDE-47[c]	318	100.0	1.5	10.9	19.0	34.2	103	1290	20.3 (2.6)	23.9 (2.2)
BDE-66	287	1.7	0.1	0.3	0.3	0.4	1.1	2.6	0.3 (1.6)	-
BDE-85	287	47.4	0.2	0.3	0.5	1.0	3.5	38.7	0.6 (2.3)	-
BDE-99[c]	306	99.0	0.6	2.4	4.4	7.9	32.7	465	4.8 (2.8)	5.5 (0.8)
BDE-100[c]	287	97.9	0.4	2.1	3.5	8.1	25.4	172	4.0 (2.8)	6.1 (0.9)
BDE-153[c]	287	98.6	0.5	2.6	4.5	9.0	45.5	152	5.3 (2.9)	9.9 (3.0)
BDE-154	287	42.9	0.2	0.3	0.5	1.0	2.9	28.7	0.6 (2.3)	-
BDE-183	287	22.6	0.1	0.3	0.4	0.6	1.1	9.3	0.4 (1.8)	-

Abbreviations: GM, geometric mean; GSD, geometric standard deviation; Max, maximum; Min, minimum.

[a] Measured at 16±3 weeks of gestation

[b] Includes congeners with detection frequencies >80% (BDEs 28, 47, 99, 100, and 153)

[c] Included in statistical analyses

[d] Serum concentrations in pregnant women in NHANES 2003-2004, as reported by Woodruff et al

[e] Not available

Table S2. Spearman rank correlation matrix for polybrominated diphenyl ethers (ng/g lipid), HOME Study

PBDEs[a]	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153
BDE-28					
BDE-47	0.86[*]				
BDE-99	0.75[*]	0.92[*]			
BDE-100	0.77[*]	0.90[*]	0.85[*]		
BDE-153	0.46[*]	0.50[*]	0.48[*]	0.73[*]	
∑PBDEs	0.82[*]	0.92[*]	0.88[*]	0.96[*]	0.73[*]

[*] $p<0.0001$.

[a] Total n for each of the pairwise correlations with BDE-28, -47, -99, -100, -153, and ∑PBDEs ranged from 287 to 306.

Table S3. Anthropometric measures in children at ages 1, 2, 3, 4, 5, and 8 years, HOME Study

	Year	*n*	Mean±SD or %
Weight z-scores	1	296	-0.29±1.17
	2	251	-0.07±1.19
	3	225	0.13±1.13
	4	174	0.21±1.13
	5	192	0.15±1.09
	8	216	0.39±1.10
Height z-scores	1	297	0.21±1.06
	2	249	0.07±1.04
	3	224	0.11±1.08
	4	173	0.28±1.14
	5	192	0.23±1.12
	8	216	0.24±1.14
BMI z-scores	2	246	0.02±1.03
	3	224	0.04±1.06
	4	173	0.15±1.13
	5	192	0.20±1.00
	8	216	0.35±0.98
Waist Circumference (cm)	4	171	51.9±4.4
	5	190	53.5±5.1
	8	211	60.7±8.2
Body Fat Percentage	8	210	20.8±6.1
Overweight or Obese[a]	2	41	16.7
	3	37	16.5
	4	31	17.9
	5	36	18.8
	8	53	24.5

Abbreviations: SD, standard deviation.

[a] BMI z-score ≥85th percentile

Table S4. Comparing maternal and child characteristics of participants included and excluded in the examination of prenatal polybrominated diphenyl ethers and child anthropometric measures, HOME Study

	Included		Excluded	
	n	**(%)[a]**	**n**	**(%)[a]**
Maternal age, years[b]				
<25	67	(21.1)	29	(40.9)
25-34	197	(62.0)	34	(47.9)
≥35	54	(17.0)	8	(11.3)
Race/ethnicity[b]				
Non-Hispanic White	211	(66.4)	26	(39.4)
Non-Hispanic Black and Others	107	(33.7)	40	(60.6)
Education[b]				
High school or less	73	(23.0)	27	(40.9)
Some college/2 yr degree	76	(23.9)	17	(25.8)
Bachelor's	102	(32.1)	8	(12.1)
Graduate or professional	67	(21.1)	14	(21.2)
Family Income[b]				
<$40,000	115	(36.2)	38	(57.6)
$40,000-$79,999	112	(35.2)	16	(24.2)
≥$80,000	91	(28.6)	12	(18.2)
Maternal Depression				
Minimal/mild	290	(91.8)	59	(90.8)
Moderate/severe	26	(8.2)	6	(9.2)
Maternal Smoking[b]				
None	274	(86.2)	47	(66.2)
ETS	21	(6.6)	14	(19.7)
Active	23	(7.2)	10	(14.1)
Prepregnancy BMI				
Underweight/Normal	166	(52.2)	39	(54.9)
Overweight	86	(27.0)	15	(21.1)
Obese	66	(20.8)	17	(23.9)
Marital status				
Married/living with partner	254	(79.9)	50	(75.8)
Not married, living alone	64	(20.1)	16	(24.2)
Fresh fruit and vegetable intake during pregnancy				
≥Daily	258	(81.1)	47	(71.2)
<Daily	60	(18.9)	19	(28.8)
Child Sex				
Male	146	(45.9)	35	(49.3)
Female	172	(54.1)	36	(50.7)

Abbreviations: GM, geometric mean; GSD, geometric standard deviation; SD, standard deviation.

[a] Frequencies may not add to the total number of participants because of missing values.

[b] $p < 0.05$

Table S5. Odds ratios and 95% confidence intervals of being overweight or obese[a] at 2, 3, 4, 5, and 8 years of age by 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid), HOME Study

PBDEs	*n*	Unadjusted OR (95% CI)	*n*	Adjusted[b] OR (95% CI)
BDE-28	263	1.59 (0.80, 3.15)	263	1.03 (0.50, 2.13)
BDE-47	289	1.66 (0.94, 2.95)	289	1.01 (0.54, 1.88)
BDE-99	279	1.43 (0.82, 2.50)	279	0.77 (0.41, 1.45)
BDE-100	263	1.37 (0.78, 2.42)	263	0.90 (0.49, 1.64)
BDE-153	263	0.63 (0.34, 1.13)	263	0.64 (0.35, 1.17)
∑PBDEs	263	1.34 (0.73, 2.49)	263	0.80 (0.41, 1.54)

PBDEs were $\log_{10}$-transformed

[a] BMI z-score $\geq 85^{th}$ percentile

[b] Adjusted by maternal age, race, education, income, maternal smoking status, maternal depression, fresh fruit and vegetable intake during pregnancy, and pre-pregnancy BMI

Table S6. Odds ratios and 95% confidence intervals of having a BMI z-score ≤15th percentile at 2, 3, 4, 5, and 8 years of age by 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid), HOME Study

PBDEs	*n*	Unadjusted OR (95% CI)	*n*	Adjusted[a] OR (95% CI)
BDE-28	263	1.62 (0.76, 3.49)	263	1.81 (0.81, 4.04)
BDE-47	289	1.16 (0.59, 2.28)	289	1.35 (0.64, 2.83)
BDE-99	279	1.38 (0.74, 2.60)	279	1.92 (0.94, 3.94)
BDE-100	263	1.56 (0.82, 2.95)	263	1.88 (0.94, 3.73)
BDE-153	263	2.18 (1.22, 3.90)	263	2.18 (1.16, 4.08)
∑PBDEs	263	1.64 (0.82, 3.25)	263	2.02 (0.95, 4.31)

PBDEs were log$_{10}$-transformed

[a] Adjusted by maternal age, race, education, income, maternal smoking status, maternal depression, fresh fruit and vegetable intake during pregnancy, and pre-pregnancy BMI

Table S7. Estimated differences and 95% confidence intervals in child anthropometric measures[a] with 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid) by child sex, HOME Study

PBDEs	p for interaction	Adjusted[b] Males β (95% CI)	Females β (95% CI)
Weight z-score[c]			
BDE-28	0.881	-0.25 (-0.74, 0.24)	-0.30 (-0.73, 0.13)
BDE-47	0.749	-0.13 (-0.54, 0.27)	-0.22 (-0.59, 0.15)
BDE-99	0.257	-0.10 (-0.47, 0.27)	-0.40 (-0.78, -0.02)
BDE-100	0.818	-0.24 (-0.64, 0.15)	-0.18 (-0.55, 0.18)
BDE-153	0.506	-0.33 (-0.69, 0.04)	-0.16 (-0.51, 0.19)
∑PBDEs	0.836	-0.24 (-0.67, 0.19)	-0.30 (-0.70, 0.09)
Height z-score[d]			
BDE-28	0.932	0.05 (-0.40, 0.50)	0.02 (-0.37, 0.42)
BDE-47	0.958	0.05 (-0.33, 0.42)	0.03 (-0.31, 0.38)
BDE-99	0.348	0.14 (-0.20, 0.49)	-0.09 (-0.43, 0.26)
BDE-100	0.591	-0.08 (-0.44, 0.29)	0.06 (-0.28, 0.40)
BDE-153	0.065[*]	-0.32 (-0.65, 0.01)	0.12 (-0.20, 0.44)
∑PBDEs	0.746	-0.06 (-0.45, 0.34)	0.03 (-0.33, 0.40)
BMI z-score[e]			
BDE-28	0.288	-0.40 (-0.87, 0.07)	-0.07 (-0.46, 0.32)
BDE-47	0.666	-0.15 (-0.54, 0.24)	-0.04 (-0.38, 0.30)
BDE-99	0.893	-0.20 (-0.56, 0.16)	-0.16 (-0.52, 0.19)
BDE-100	0.686	-0.26 (-0.64, 0.11)	-0.16 (-0.50, 0.18)
BDE-153	0.428	-0.26 (-0.60, 0.08)	-0.45 (-0.77, -0.13)
∑PBDEs	0.843	-0.29 (-0.69, 0.12)	-0.23 (-0.60, 0.14)
Waist Circumference[e,f]			
BDE-28	0.129	-2.70 (-5.37, -0.03)	-0.05 (-2.20, 2.09)
BDE-47	0.134	-2.17 (-4.34, -0.004)	-0.01 (-1.93, 1.92)
BDE-99	0.257	-2.23 (-4.28, -0.19)	-0.65 (-2.62, 1.33)
BDE-100	0.203	-2.50 (-4.59, -0.41)	-0.70 (-2.58, 1.18)
BDE-153	0.804	-2.01 (-4.01, -0.0001)	-1.67 (-3.39, 0.04)
∑PBDEs	0.191	-2.68 (-4.95, -0.40)	-0.67 (-2.71, 1.37)
Body Fat Percentage[e,f]			
BDE-28	0.345	-1.58 (-5.72, 2.56)	0.84 (-2.11, 3.78)
BDE-47	0.477	-1.54 (-5.08, 2.00)	-0.01 (-2.61, 2.59)
BDE-99	0.545	-1.92 (-5.21, 1.37)	-0.69 (-3.37, 1.98)
BDE-100	0.530	-1.90 (-5.07, 1.26)	-0.64 (-3.19, 1.91)
BDE-153	0.595	-1.81 (-4.58, 0.97)	-2.77 (-5.16, -0.39)
∑PBDEs	0.625	-2.20 (-5.81, 1.42)	-1.10 (-3.87, 1.68)

PBDEs were $\log_{10}$-transformed

[a] At 1-8 years of age for weight and height z-scores, 2-8 years of age for BMI z-scores, 4-8 years of age for waist circumference, and 8 years of age for body fat percentage

[b] Adjusted by maternal age, race, education, income, maternal smoking status, maternal depression, and fresh fruit and vegetable intake during pregnancy.

[c] Additionally adjusted by pre-pregnancy weight; [d] maternal height; [e] pre-pregnancy BMI; [f] child sex and child age

Table 8. Estimated differences and 95% confidence intervals[a] in child anthropometric measures[b] by 10-fold increases in maternal serum concentrations of polybrominated diphenyl ethers (ng/g lipid) with additional adjustment for environmental contaminants,[c] HOME Study

PBDEs	Weight z-scores[d] β (95% CI)	Height z-scores[e] β (95% CI)	BMI z-scores[f] β (95% CI)	Waist Circumference[f,g] β (95% CI)	Body Fat Percentage[f,g] β (95% CI)
PFOA[h]					
BDE-28	-0.29 (-0.62, 0.04)	-0.04 (-0.35, 0.26)	-0.21 (-0.52, 0.10)	-1.52 (-3.26, 0.21)	-0.42 (-2.93, 2.09)
BDE-47	-0.18 (-0.46, 0.10)	0.004 (-0.26, 0.27)	-0.09 (-0.36, 0.18)	-1.17 (-2.68, 0.35)	-0.90 (-3.12, 1.31)
BDE-99	-0.26 (-0.53, 0.02)	-0.004 (-0.26, 0.25)	-0.19 (-0.45, 0.08)	-1.52 (-3.01, -0.03)	-1.33 (-3.54, 0.88)
BDE-100	-0.22 (-0.49, 0.06)	-0.06 (-0.31, 0.20)	-0.21 (-0.47, 0.05)	-1.69 (-3.14, -0.24)	-1.44 (-3.51, 0.62)
BDE-153	-0.24 (-0.50, 0.02)	-0.14 (-0.38, 0.10)	-0.37 (-0.61, -0.13)	-1.99 (-3.33, -0.64)	-4.86 (-4.74, -0.97)
∑PBDEs	-0.28 (-0.58, 0.02)	-0.06 (-0.34, 0.22)	-0.27 (-0.55, 0.01)	-1.79 (-3.36, -0.22)	-1.83 (-4.13, 0.46)
PFOS[i]					
BDE-28	-0.31 (-0.65, 0.02)	-0.07 (-0.38, 0.23)	-0.22 (-0.53, 0.09)	-1.37 (-3.11, 0.37)	-0.37 (-2.91, 2.17)
BDE-47	-0.19 (-0.48, 0.10)	-0.02 (-0.29, 0.25)	-0.09 (-0.36, 0.18)	-1.06 (-2.58, 0.46)	-0.96 (-3.19, 1.28)
BDE-99	-0.26 (-0.54, 0.02)	-0.02 (-0.28, 0.23)	-0.18 (-0.45, 0.08)	-1.46 (-2.94, 0.03)	-1.37 (-3.60, 0.85)
BDE-100	-0.23 (-0.51, 0.05)	-0.09 (-0.34, 0.17)	-0.21 (-0.47, 0.04)	-1.56 (-3.01, -0.11)	-1.44 (-3.54, 0.65)
BDE-153	-0.26 (-0.52, 0.003)	-0.16 (-0.40, 0.08)	-0.38 (-0.62, -0.14)	-1.85 (-3.18, -0.52)	-2.77 (-4.67, -0.87)
∑PBDEs	-0.30 (-0.60, 0.005)	-0.09 (-0.37, 0.19)	-0.27 (-0.55, 0.01)	-1.66 (-3.23, -0.09)	-1.84 (-4.17, 0.48)
∑PCBs[j]					
BDE-28	-0.27 (-0.59, 0.05)	0.06 (-0.24, 0.35)	-0.17 (-0.48, 0.13)	-0.96 (-2.65, 0.74)	0.25 (-2.20, 2.70)
BDE-47	-0.17 (-0.45, 0.12)	0.09 (-0.17, 0.35)	-0.10 (-0.37, 0.18)	-0.98 (-2.54, 0.57)	-0.32 (-2.64, 2.01)
BDE-99	-0.22 (-0.50, 0.06)	0.08 (-0.18, 0.33)	-0.17 (-0.44, 0.09)	-1.38 (-2.90, 0.14)	-1.03 (-3.32, 1.26)
BDE-100	-0.20 (-0.46, 0.07)	0.02 (-0.23, 0.26)	-0.19 (-0.45, 0.06)	-1.42 (-2.85, 0.01)	-1.00 (-3.06, 1.05)
BDE-153	-0.23 (-0.48, 0.02)	-0.10 (-0.33, 0.13)	-0.35 (-0.59, -0.12)	-1.76 (-3.07, -0.45)	-2.30 (-4.15, -0.45)
∑PBDEs	-0.25 (-0.54, 0.04)	0.03 (-0.24, 0.29)	-0.24 (-0.52, 0.04)	-1.46 (-3.01, 0.10)	-1.32 (-3.62, 0.97)
DDE[k]					
BDE-28	-0.37 (-0.69, -0.04)	-0.02 (-0.31, 0.28)	-0.24 (-0.55, 0.07)	-1.37 (-3.07, 0.33)	-0.23 (-2.72, 2.25)
BDE-47	-0.22 (-0.49, 0.06)	0.02 (-0.24, 0.28)	-0.10 (-0.36, 0.16)	-1.11 (-2.60, 0.37)	-0.77 (-2.97, 1.43)
BDE-99	-0.26 (-0.53, 0.01)	0.03 (-0.22, 0.28)	-0.19 (-0.45, 0.07)	-1.50 (-2.98, -0.03)	-1.29 (-3.49, 0.92)
BDE-100	-0.25 (-0.52, 0.02)	-0.03 (-0.28, 0.22)	-0.22 (-0.48, 0.04)	-1.67 (-3.10, -0.24)	-1.36 (-3.43, 0.71)
BDE-153	-0.24 (-0.49, 0.01)	-0.10 (-0.33, 0.13)	-0.36 (-0.60, -0.13)	-1.85 (-3.15, -0.54)	-2.45 (-4.29, -0.60)
∑PBDEs	-0.31 (-0.60, -0.02)	-0.02 (-0.29, 0.24)	-0.27 (-0.55, 0.01)	-1.72 (-3.27, -0.18)	-1.73 (-4.02, 0.56)

DEHP[l]					
BDE-28	-0.30 (-0.63, 0.03)	-0.02 (-0.33, 0.28)	-0.23 (-0.54, 0.08)	-1.54 (-3.22, 0.15)	0.09 (-2.41, 2.60)
BDE-47	-0.19 (-0.47, 0.09)	-0.01 (-0.27, 0.26)	-0.10 (-0.36, 0.17)	-1.19 (-2.66, 0.28)	-0.59 (-2.81, 1.63)
BDE-99	-0.26 (-0.53, 0.02)	-0.001 (-0.25, 0.25)	-0.19 (-0.45, 0.08)	-1.54 (-3.00, -0.08)	-1.12 (-3.34, 1.11)
BDE-100	-0.23 (-0.50, 0.05)	-0.04 (-0.29, 0.21)	-0.23 (-0.48, 0.03)	-1.69 (-3.09, -0.28)	-1.24 (-3.31, 0.82)
BDE-153	-0.27 (-0.53, -0.01)	-0.12 (-0.35, 0.11)	-0.40 (-0.63, -0.16)	-2.02 (-3.31, -0.73)	-2.57 (-4.43, -0.71)
∑PBDEs	-0.30 (-0.59, 0.001)	-0.05 (-0.32, 0.22)	-0.28 (-0.56, -0.002)	-1.80 (-3.33, -0.27)	-1.60 (-3.91, 0.70)
BPA[m]					
BDE-28	-0.29 (-0.62, 0.03)	-0.03 (-0.33, 0.28)	-0.21 (-0.52, 0.10)	-1.42 (-3.12, 0.28)	0.21 (-2.29, 2.70)
BDE-47	-0.19 (-0.47, 0.10)	-0.01 (-0.27, 0.26)	-0.08 (-0.35, 0.19)	-1.11 (-2.61, 0.38)	-0.32 (-2.54, 1.91)
BDE-99	-0.25 (-0.53, 0.02)	-0.005 (-0.26, 0.25)	-0.17 (-0.43, 0.10)	-1.45 (-2.93, 0.03)	-0.81 (-3.06, 1.43)
BDE-100	-0.23 (-0.50, 0.05)	-0.05 (-0.31, 0.20)	-0.21 (-0.47, 0.05)	-1.69 (-3.13, -0.26)	-0.94 (-3.02, 1.14)
BDE-153	-0.27 (-0.53, -0.01)	-0.14 (-0.37, 0.10)	-0.38 (-0.62, -0.14)	-2.07 (-3.39, -0.75)	-2.33 (-4.21, -0.45)
∑PBDEs	-0.30 (-0.59, 0.003)	-0.06 (-0.34, 0.21)	-0.26 (-0.54, 0.02)	-1.78 (-3.34, -0.22)	-1.30 (-3.62, 1.02)

PBDEs were log_{10}-transformed

[a] Adjusted by maternal age, race, education, income, maternal smoking status, maternal depression, fresh fruit and vegetable intake during pregnancy
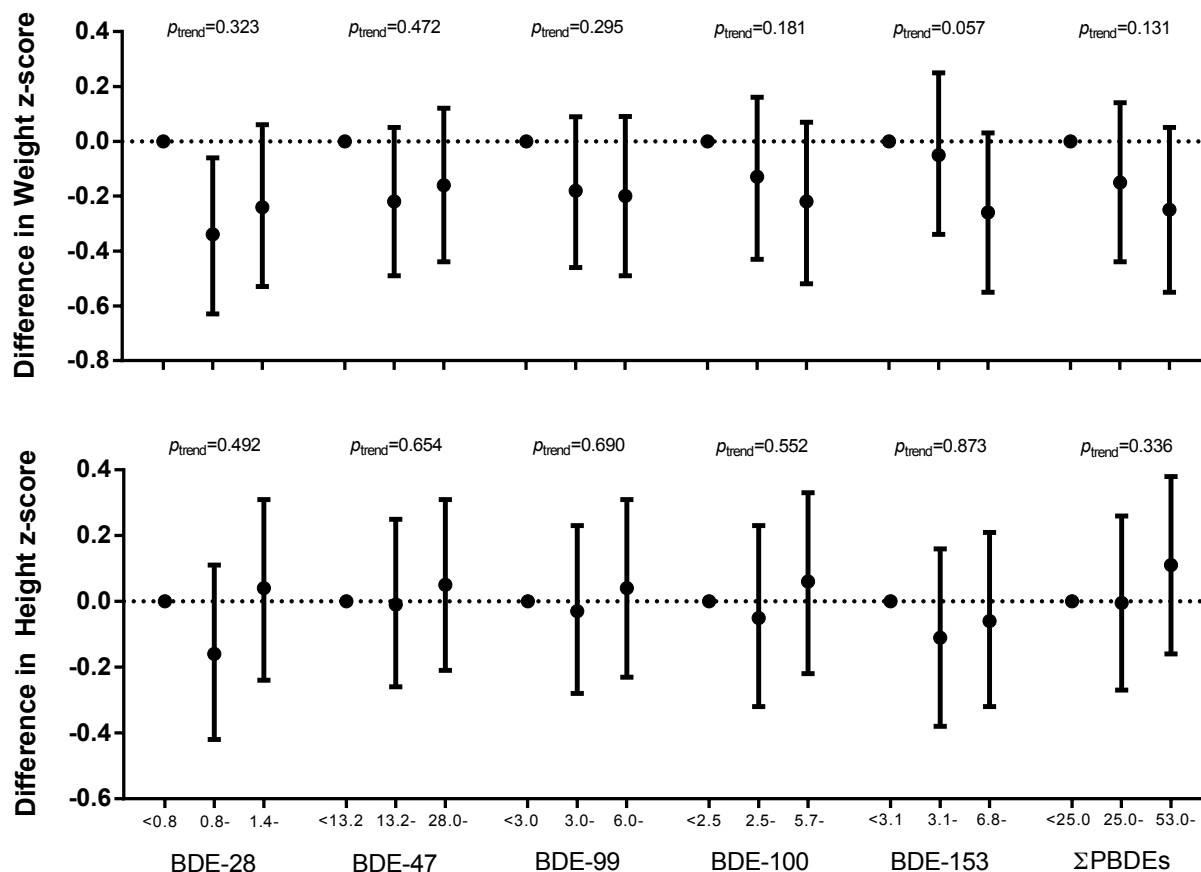
[b] At 1-8 years of age for weight and height z-scores, 2-8 years of age for BMI z-scores, 4-8 years of age for waist circumference, and 8 years of age for body fat percentage

[c] Maternal concentrations at 16±3 weeks of gestation

[d] Additionally adjusted by pre-pregnancy weight; [e] maternal height; [f] pre-pregnancy BMI; [g] child sex and child age

[h] Models of child anthropometric measures additionally adjusted by maternal concentrations of PFOA; [i] PFOS; [j] ∑PCBs; [k] DDE; [l] DEHP; and [m] BPA.

Figure S1. Estimated differences and 95% CIs from multiple linear mixed models for associations between polybrominated diphenyl ether (ng/g lipid) tertiles and weight or height z-scores in children. All models adjusted for maternal age, race, education, income, maternal smoking status, maternal depression, and maternal fruit and vegetable intake during pregnancy. Weight z-score models were additionally adjusted for pre-pregnancy weight. Height z-score models were additionally adjusted for maternal height.

Reference

Woodruff TJ, Zota AR, Schwartz JM. 2011. Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environ Health Perspect 119:878-885.